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EVALUATION OF WASTEWATER TREATMENT PLANTS AT HENDERSON, NEVADA

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TECHNICAL REPORT

EVALUATION OF WASTEWATER TREATMENT PLANTS

AT

HENDERSON, NEVADA

Surveillance and Analysis Division
United States Environmental Protection Agency
Region IX
San Francisco, CA 94111

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Report evaluates two wastewater treatment plants at Henderson NV, covering their physical structure (one plant was in deteriorated condition) their operation, and to determine the source of high salinity effluent from the plants

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EVALUATION OF WASTEWATER TREATMENT PLANTS

AT HENDERSON, NEVADA

I. BACKGROUND

At the request of the Enforcement Division, Environmental Protection Agency, Region IX, the Surveillance and Analysis Division performed operation and maintenance inspections of the two wastewater treatment plants operated by the City of Henderson, Nevada. In December 1971, the City received a 180-day notice from EPA to upgrade its wastewater treatment. As of March 1973, little or no progress had been made. The EPA therefore initiated an investigation to determine the City's status of compliance.

II. OBJECTIVES

The objectives of the investigation were:

1. To evaluate the physical structure of the two wastewater treatment plants owned by the City of Henderson.

2. To evaluate the operation of the wastewater treatment plants.

3. To determine the source of high salinity effluent reported occurring at the wastewater treatment plants.

III. ORGANIZATION

The investigation was conducted by James R. Jones, Sanitary Engineer, Surveillance and Analysis Division, EPA, Region IX. It involved meeting on the afternoon of March 5, 1973 at the Henderson City Hall with Robert Whitney, Director of Public Works, Henry Greenville, Consultant, and John McCormack, Treatment Plant Operator. This was followed by an on-site inspection of the plants with John McCormack on March 7 and March 8, 1973. Wastewater samples were collected at that time in an effort to pinpoint sources of high salinity. No attempt was made to evaluate removal efficiencies of the plants.

IV. FINDINGS AND DISCUSSION

A. Henderson Wastewater Treatment Plant No. 1

The Henderson Wastewater Treatment Plant No. 1 (Figure 1) was built in 1957 with a grant from the U. S. Public Health Service. The plant consists of two Imhoff tanks operated in parallel followed by two oxidation ponds operating in series. The plant serves some 9,000 persons or approximately one-half of the population of Henderson. The average daily flow is approximately 1890 cubic meters per day (0.5 mgd) and consists entirely of domestic wastewater.

Each Imhoff tank is 7.3 meters (24 feet) high with a diameter of 13.7 meters (45 feet). The surface loading is approximately 6.5 cu. m/day/sq m (160 gallons/square foot/day) and the theoretical detention time in the settling zone of the tank is about 7 hours. Both surface loading and detention time are within commonly accepted limits. The general appearance of the Imhoff tanks was acceptable, and the units appeared to be operating in a satisfactory manner. They had been kept clean, and it was observed that parts had recently been painted.

The wastewater flows directly from the Imhoff tanks to two oxidation ponds. Each pond is 107 meters by 107 meters (350 feet by 350 feet), or 6.9 hectares (2.8 acres). The first pond is 1.8 m (6 feet) deep while the second is 2.1 m (7 feet) deep. Assuming a wastewater influent flow of 1890 cubic meters per day (0.5 mgd), the theoretical detention time in the ponds is approximately 24 days. The ponds were sealed at the time of construction with soil cement and have no significant weed growths or problems with embankments. The effluent from the oxidation ponds flows directly to holding ponds, operated by Basic Management, Inc. (BMI), from which there is no direct discharge.

Sludge drying beds are located in the northeast corner of the facility. Sludge from the Imhoff tanks discharges to these beds, and the dried sludge is stockpiled next to the beds.

Results of grab samples taken at Plant No. 1 are shown in Table 1. Total dissolved solids (TDS) are high in the influent wastewater and are slightly higher in the effluent. This increase can be attributed to evaporation from the ponds, and normal variation between a single influent grab sample and a single pond effluent sample which reflects flow averaging. The TDS concentration is significantly higher than that found at Plant No. 2, even though the same water supply is used throughout the City. Plant No. 1 is located in an area of high ground water levels (near Pittman), and infiltration may affect the water quality. Additionaly, there is one influent line which the operators believe might be tied into an old leach field in the Pittman area.

In general, the plant is being operated and maintained in an acceptable manner. Because of the simplicity of the Imhoff tank and oxidation pond system, little maintenance is required and highly skilled operation is not needed. The plant does not appear to be overloaded and with maintenance now being done by the operator, it seems that the plant is operating in the range of removal rates expected for a plant of this type.

B. Henderson Wastewater Treatment Plant No. 2

The Henderson Wastewater Treatment Plant No. 2 (Figure 2) was formerly owned and operated by BMI. The two-stage trickling filter plant was built in 1943 to treat both domestic and industrial wastewater from the BMI complex and approximately half of the sewage from the City of Henderson. In 1972, the plant was sold to the City of Henderson which is now restoring the plant to an operating condition. Over the years, a lack of maintenance and the effects of industrial waste have left the plant in a deteriorated condition.

The headworks for the plant collect wastewater from three pipes, one from the BMI complex and the other two from portions of the City of Henderson. The wastewater then flows through two grit removal channels, a Parshall flume and two comminuters. At present, the concrete in the channels is badly eroded from the effects of industrial waste. The level recorder at the Parshall flume has been removed and a new one has been ordered. Until that is installed, there is no way to measure the flow through the plant. The two comminuters appear to be doing a satisfactory job. A biocatalytic agent, Bio-Cat 1, is being added to the Parshall flume.

Following the headworks, the wastewater passes through a primary clarifier which is 18.3 m (60 feet) in diameter and 3.7 m (12 feet) deep. At the time of the inspection, the clarifier had been recently drained and the bottom sludge scraper arm repaired. The scum collector arm had been removed while the scum collection box was still intact. The clarifier appeared to be operable; however, sludge had not been removed since the digesters were not being used. The v-notched weir, the scum box and other exposed metal parts were quite corroded or rusted but appeared usable.

The two trickling filters, operated as a two-stage system, are both 18.3 m (60 feet) in diameter with approximately 1.8 m (6 feet) of rock media. Both filters have suffered severely from the effects of industrial wastewater. The concrete walls of the units have pronounced vertical cracks; however, the units are not in any apparent danger of collapsing nor are operations significantly affected by the cracks.

At the time of the inspection, only the primary filter was being operated. The distributor arm on the filter was severly deteriorated and was not rotating. Wastewater was flowing out of several holes in the bottom of the distributor arm near the center of the filter, resulting in ponding of the wastewater at the center with none reaching the outer portion of the bed. The filter was being

operated with no return flow. There is piping which would allow returning a portion of the flow from the sump (under the control building) back through the primary clarifier; however, no workable pump is presently available. Because of the high organic loading, it would be advisable to return flow in order to reach higher BOD removal efficiencies and to stabilize the hydraulic loading. [On March 16, photographs were taken by the plant operator of the repaired distributor arm and forwarded to this office. It appears the unit is now functioning.]

The secondary trickling filter is not being used at present because no pump is available to pump return flow from the sump under the control building. The condition of the unit is similar to that of the primary filter. A significant amount of repair work in addition to a new pump would be required before it could resume operation.

The final clarifier was not being used at the time of the inspection. It was quite septic and probably contained a great deal of sludge. Prior to future use, the unit will undoubtedly need to undergo repairs similar to those made on the primary clarifier.

The treatment plant effluent flows to a channel containing industrial wastewater from BMI. The combined wastewater is then discharged to holding ponds operated by BMI. There, it either evaporates or percolates to the groundwater. Results of one grab sample taken in the channel above the point where the treatment plant effluent is discharged are shown in Table 1. The industrial wastewater flow in the channel appears to be three or four times greater than that from the treatment plant.

Primary and secondary digesters were quite deteriorated and are not in use at this time. The sludge pumps, as well as the heater from the primary digesters, were not in a workable condition and require replacement. The top to the secondary digester was dented and in general poor condition.

The units will be drained and cleaned by the operators in the near future, and it is likely that the interiors will be found to be severely deteriorated. The condition of the pipes is not known, but these, too, are probably in poor condition.

The plant is operated on gravity flow through the headworks, the primary clarifier and the primary trickling filter. Beyond that point, new pumps would be needed to pump from the sump (under the control house) to the secondary trickling filter in the final clarifier. Presently, the flow bypasses the remainder of the plant after the primary filter.

Analysis of the plant influents from the City of Henderson and BMI as well as plant effluent show no significant variations that would indicate any discharge other than domestic wastewater (see Table 1). Claims that BMI is discharging industrial wastes could not be verified or discounted by the results shown. On the other hand, at one time during the inspection, a distinct pungent odor similar to ammonia was noted. Mr. Glenn Taylor of BMI, in a telephone conversation on March 19, 1973, stated that their industrial plants are not discharging anything except domestic sewage.

No analysis was made of the influent or effluent to determine removal efficiencies nor were sufficient data available from the City. As the plant was mostly inoperable at the time of the inspection, it could be assumed that little or no reduction or stabilization of the organic matter was accomplished.

Generally, the plant is in a deteriorated condition. Because of the many years of operation without proper maintenance and the nature of the wastewater treated, all of the units, pumps and piping are either inoperable or have severe limitations. Any attempt to repair the facility and keep it operating for extended periods will be costly in terms of materials or manpower.

C. Monitoring Programs

Neither plant has a monitoring program which is sufficient to indicate plant removal efficiencies. The only parameters measured at both plants are settleable solids, pH, and temperature. A record of wastewater flow is kept at Plant No. 1. At present, there are no means by which the flow at Plant No. 2 can be recorded. The plant personnel realize the problem and expect to expand the monitoring program as soon as reconstruction of Plant No. 2 is completed.

D. Biocatalytic System Study

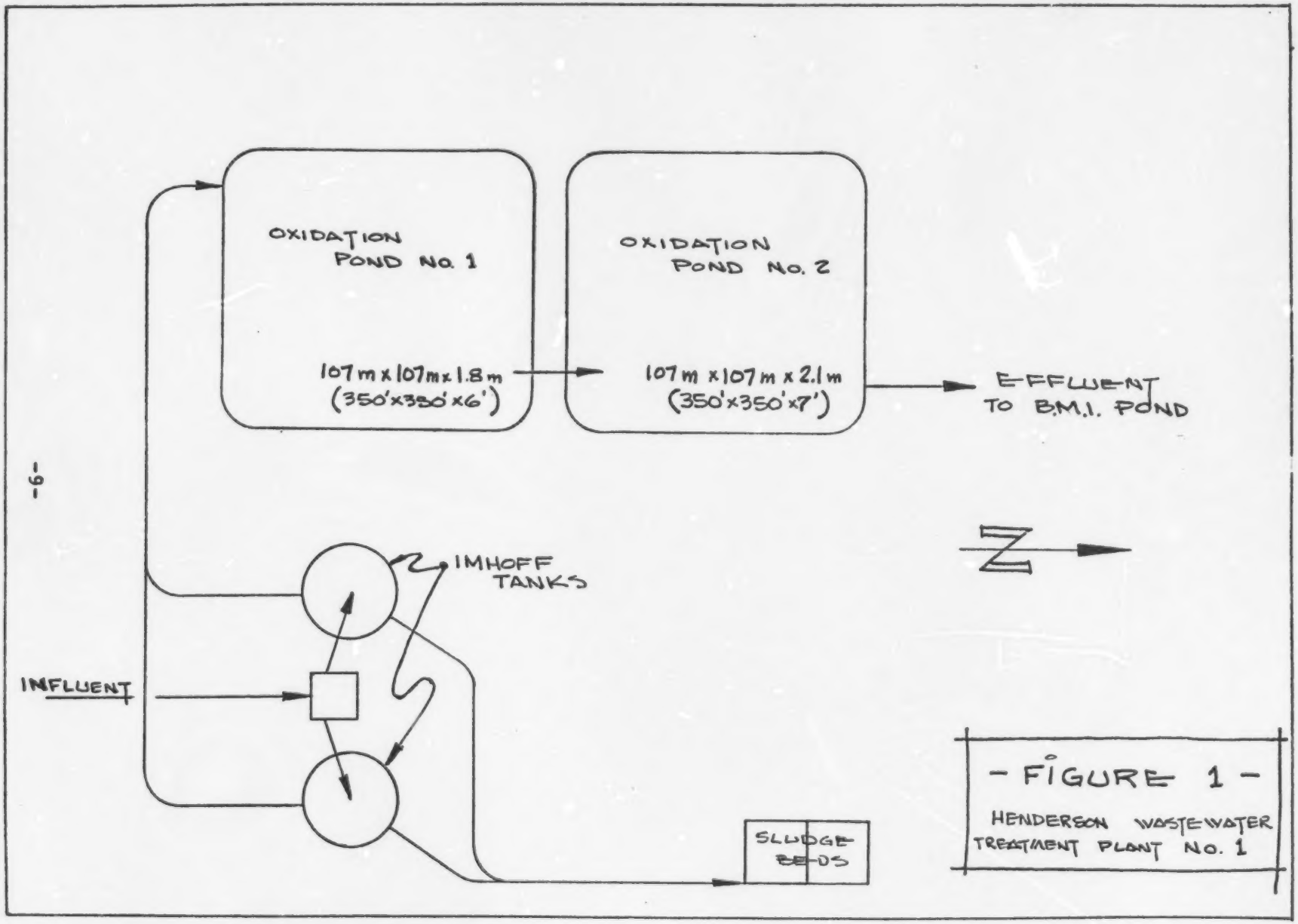
The City of Henderson has proposed to study, and would like a grant to evaluate, the use of a liquid biocatalytic agent used to increase the rate of biodegradation. They propose to use this catalytic agent at both treatment plants and feels that removal efficiencies would be increased. The agent, named "Bio-Cat 1", is a solution containing enzymes with organic and biochemical ingredients. (See Attachment No. 1 for further description by Henry Greenville, Consultant to the City of Henderson.) At this point, no data or information have been brought forward to support the claims expressed by the Biochemical Engineering Corporation of Henderson, Nevada or the City of Henderson. A limited amount of data is available from November 1972 when the No. 2 plant was operated, but there were no controls or method to compare removal efficiencies. For the same reasons, any future attempt to evaluate Bio-Cat 1 would not be valid unless controls were available.

V. CONCLUSIONS

1. The City of Henderson Wastewater Treatment Plant No. 1 is being operated and maintained in an acceptable manner. The level of removal attained by the plant appears to be in the range that would be expected from a plant of this type.

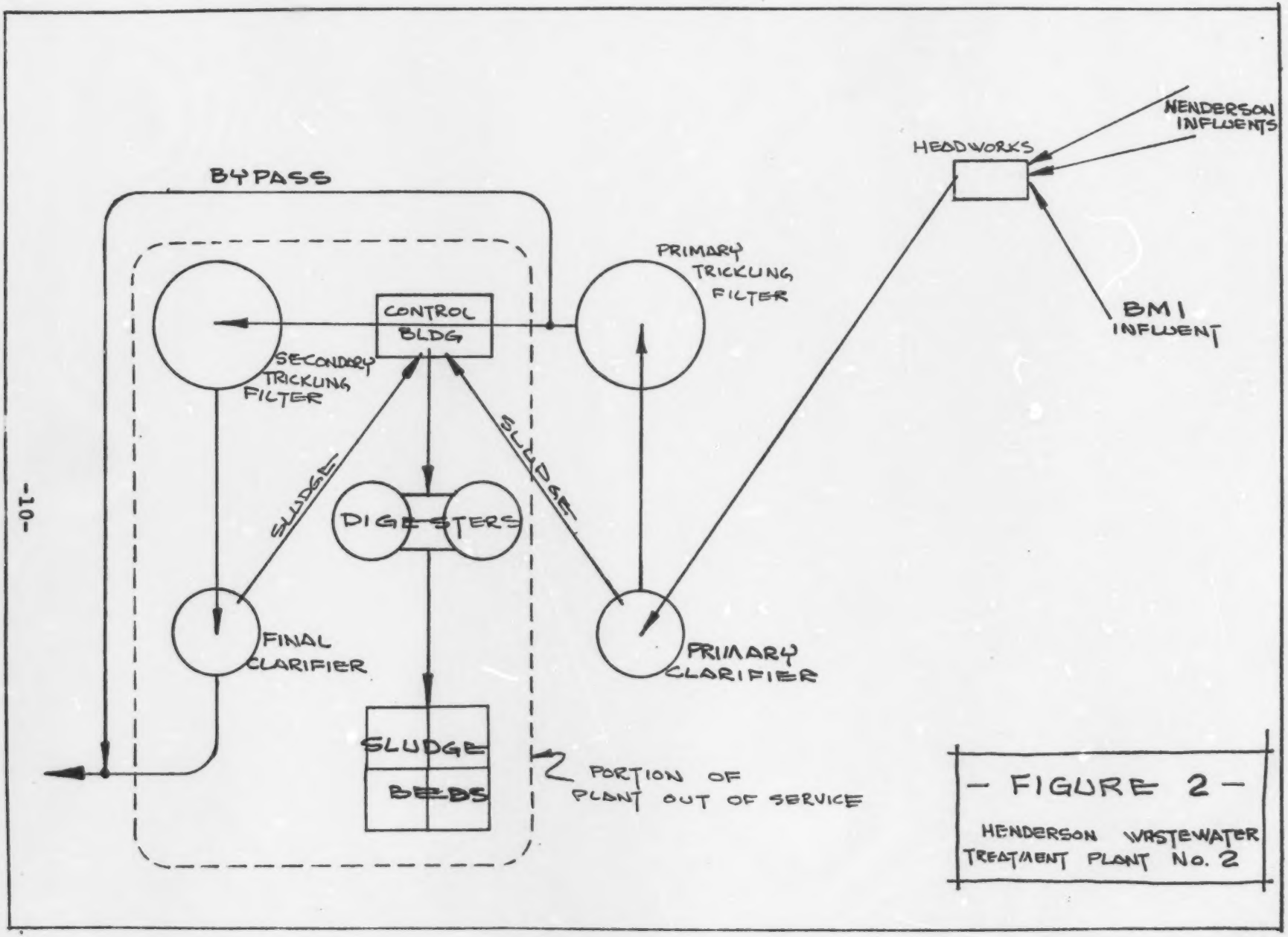
2. Wastewater Treatment Plant No. 2 is in a deteriorated condition and attempts to repair and operate it in an acceptable manner will be costly. As the plant is mostly inoperable, it could be assumed that little or no reduction or stabilization of the organic matter was accomplished.

3. High TDS concentrations were found in the influent to Plant No. 1 and may be caused by infiltration in the Pittman area. No significant high TDS values were found in the influent to Plant No. 2.



- FIGURE 1 -

HENDERSON WASTEWATER TREATMENT PLANT NO. 1



- FIGURE 2 -

HENDERSON WASTEWATER TREATMENT PLANT No. 2

TABLE NO. 1

Selected Samples at Henderson, Nevada
Wastewater Treatment Plants

SAMPLE		1	2	3	4	5	6	7	8
		← Plant No. 2 →					← Plant No. 1 →		BMI Channel
PARAMETER		Effluent	Influent (BMI)	Influent (Henderson)	Influent (BMI)	Influent (Henderson)	Influent	Effluent	Effluent
Sample Date & Time		3/7/73 @1400	3/7/73 1400	3/7/73 1400	3/8/73 0800	3/8/73 0800	3/8/73 1000	3/8/73 1010	3/8/73 0915
Carbonate	(mg/l)	228	190	255	160	356	275	301	-
Calcium	(mg/l)	83	81	77	82	77	170	210	73
Magnesium	(mg/l)	31	32	28	30	30	69	82	412
Chloride	(mg/l)	185	192	123	117	176	430	578	1640
Sulfate	(mg/l)	360	355	404	343	360	640	702	350
Sodium	(mg/l)	199	194	196	134	197	343	407	392
Potassium	(mg/l)	14	11	19	8.6	21	19	19	7.9
Specific Conductivity	(μ mhos/cm)	1690	1610	1600	1330	1950	3030	3550	6490
Total Dissolved Solids	(mg/l)	1030	997	1030	827	1050	1940	2310	3770
pH		6.9	7.2	6.9	7.1	7.5	6.9	7.1	2.7
Total Kjeldahl-Nitrogen	(mg/l)	-	-	-	9.0	78	51	27	-
Nitrate-Nitrogen	(mg/l)				0.40	<0.01	0.11	<0.01	
Total Phosphorous	(mg/l)				2.5	17	14	11	

Bio-Cat 1

A Liquid Biocatalytic Agent For The Stimulation of Organic Decay

Bio-Cat 1 is a liquid proprietary product invention of the Biochemical Engineering Corporation, Henderson, Nevada. It is formulated from fully biodegradable organic and biochemical materials of natural and synthetic origin, and contains no materials that are toxic or hazardous to animal life. It has several active ingredients, the principal one being a multiple enzme system system obtained thru proprietary formulation and technology. Bio-Cat 1 action is catalytic and in this regard has shown broad spectrum capability to increase the natural biodegradation rate of plant and animal protein, carbohydrate and lipid materials. It functions entirely within the aerobic cycle, and when applied to an active anaerobic system effectively inhibits further action. Aeration of such an inactivated system quickly establishes aerobic activity. Experience to date in treating raw sewage has shown concentrations of Bio-Catl to be effective in the 10-25 ppm range. Sludge treatment requires separate scheduling and concentrations depending upon the degree of digestion desired. Further studies are being conducted to better define the required parameters.

It has had extensive application in lakes and ponds containing a variety of aquatic populations (fish, crustaceans, etc.) without any observable harm to any form.(concentrations up to 400 ppm have been used). The waters were effectively treated with Bio-Cat 1 to eliminate large accumulations of decaying organic residue resulting from previous kills of uncontrolled herbs and algal growths. As in the case of sewage treatment, the undesireable odor of anaerobic decay is completely and quickly eliminated without recurrence as long as the treatment process is continued or until decay is completed. In all instances the treated waters continued to support viable aquatic life.

Special formulations containing Bio-Cat 1 have been under study for more than a year in veterinary applications (dogs and cats). This has included shampooing, coat conditioning, deoderization of animals and pens. It has demonstrated to be highly effective in all applications with no evidence to date of any harmful or undesireable affects to the animals or study personnel.

*Supplied by Henry Greenville, Consultant.

This same formulation has been in use by a selected group of volunteers for approximately a year in applications involving personal hygiene (hair shampooing, body soap substitute, etc.), liquid household cleaner, etc., with excellent results as a cleaner-deoderizer with no apparent harmful or other objectionable affects.